State of Utah

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY

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UT/001/039

August 22, 1996

Mr. Rick Havenstrite
Centurion Mines Corporation
P.O. Box 2365
331 South Rio Grande Street, Suite 201
Salt Lake City, Utah 84110

Dear Mr. Havenstrite:

Subject: Copper Heap Leaching Project, OK Mine

We have reviewed plans and supporting information for the construction of a heap leach pad for copper extraction at OK Mine. The documents, prepared by the Centurion Mines Corporation, were received on July 8, 1996.

Based on the review, our comments are as follows:

1. HEAP LEACH PAD

   a. Construction plans and specifications must be prepared by a professional engineer licensed to practice in the State of Utah. A Construction Quality Assurance/Construction Quality Control (QA/QC) plan addressing liner systems for both the pad and ponds must be prepared and submitted for our review before the beginning of construction. The design, construction and quality assurance must be certified by a registered professional engineer.

   b. The area around the pad and the plant should be graded at not less than 2 percent, to eliminate ponding.

   c. The pad liner system will consist of, a 60-mil HDPE primary liner, 12 inches of compacted soil with the maximum hydraulic conductivity of 1×10^{-7} centimeters per second, filter fabric or geotextile, if needed, 6 inches of drainage layer having the minimum hydraulic conductivity of 1×10^{-2} centimeters per second, leakage collection piping placed at the maximum spacing of 200 feet on center, and 12 inches of compacted sub-base having the maximum hydraulic conductivity of 1×10^{-6} centimeters per second.

d. The exposed perimeter area around the leach pad must be double lined with high-density polyethylene [HDPE] liner. Exposed upper liner is vulnerable to physical damage.

e. A procedure for placing or heaping ore on the leach pad, should be developed to prevent any physical damage to the HDPE liners. Similar protective procedures should be considered or developed for preventing damage to liners in solution channels and launders.

f. Head on the primary liner must be limited to less than 12 inches. Design of the process solution collection system should accomplish this head limitation. Also, methods and procedure of monitoring this head over the primary liner must be considered in the design.

g. Angularity of crushed gravel material being placed on top of the HDPE liner should be considered carefully with the liner manufacturer. Sharp gravel may cause holes in the HDPE liner.

h. Thickness of a leak detection layer should be at least 6 inches. This minimum thickness is essential to facilitate the earthwork.

i. Pipes for leak detection should not be placed any farther than 200 feet apart, for detection of any leakage promptly. Details on the orientation and spacing of the perforations in leak detection pipes are necessary for our review.

j. Clay liner should be constructed in 6-inch lifts. Material must be compacted to 95 percent relative compaction using a standard Proctor test. Moisture content of the material must not be less than -1 per cent of the optimum moisture content value, or more than +3 percent of the optimum moisture content value. The report proposes compaction of the material with moisture content ranging from ±3 percent of the optimum moisture content value. We may approve the use of the material with moisture content between -1 and -3 percent of the optimum moisture content value, provided the material will be compacted to 95 percent relative compaction using a modified Proctor test.

k. Compacted clay material above the leak detection layer must not penetrate or migrate more than one-half of one inch into the leak detection media. Please detail steps to be taken for reducing such migration.

l. As the subsurface material below the pad presumably will attenuate small quantity of leaked process solutions, we agreed with the maximum hydraulic conductivity of 1×10^{-6} centimeters per second, rather than 1×10^{-7} centimeters per second. This assumption must be validated with supporting documentation for our review.

m. The native material to be used as sub-base of the pad, was selected based on a single standard proctor test. Several tests should be run before selecting the material for the sub-base. Frequency of testing will depend on the uniformity of the material tested.

2. PROCESS PONDS

a. The slope on the bottom of the process ponds should be a minimum of 5 per cent, and must not be less than 2 per cent. The minimum required grade will minimize the time for a leak to be detected. Several sumps may be needed in the pregnant liquor solution ponds to accommodate the minimum grade requirement.

b. Detail of the emergency overflow structure of the process ponds must be included in the plans.

c. Protective procedures must be developed for preventing damage to the HDPE liner from submersible pumps, moving equipment in and out of the ponds, ice buildup, etc.

d. Details of the leak detection system including sump, piping, sensor, pumps, etc. are necessary for our review.

e. The sump area should be double lined with HDPE liner.

f. The pond liner system will consist of, a 60-mil HDPE primary liner, a drainage net, a 60-mil HDPE secondary liner, and a 12-inches of compacted sub-base with the maximum hydraulic conductivity of 1×10^{-7} centimeters per second.

g. Heap leach pads, process solution ponds and the process area must be enclosed with an eight (8)-foot chain link and barbed wire fence.

3. GROUND WATER MONITORING

a. The wells must be monitored for eight [8] consecutive months to establish a baseline background ground water quality data. Samples must also be analyzed for Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, $HCO_3^{=}$, $SO_4^{=}$, Cl^{-}, $Fe^{2+ \text{ and } 3+}$, and Mn^{2+}, besides dissolved metals and the parameters in the submitted analysis.

b. The ground water quality in the monitoring well will be monitored on a quarterly basis after the background ground water quality has been established.

c. Latitude and longitude of the monitoring wells must be provided.

d. A schematic diagram of the wells must be provided to determine their acceptability for compliance monitoring points.

e. Results from the first batch of samples taken and analyzed from the monitoring wells show the quality of the water as either Class II drinking water quality ground water or Class III limited use ground water. The sample taken from MW-1 had a total dissolved solids (TDS) concentration of 785 milligrams per liter [mg per liter], and no constituents exceeding ground water quality standards. This is indicative of a Class II water. The sample taken

from MW-2 had a TDS concentration of 810 mg per liter and a total lead concentration of 0.036 mg per liter. The ground water quality standard for dissolved lead is 0.015 mg per liter. Data from the analysis for MW-2 is inconclusive as total lead concentration was determined rather than dissolved lead concentration. Future samples must be analyzed for dissolved metal constituents instead of total concentration. Please share the results of analyses from the monthly sampling of these two wells, with us for review as they become available. This will help us refine the determination of the background ground water quality determination, and consequently, informed ground water quality protection levels when the permit is issued.

f. Please develop cross-sections describing in sufficient detail, the hydro-geology underlying the pad, based on the knowledge of drill holes and wells in the area. The drawings should include projections of the wells upon the geology showing water levels in the wells and the screened interval of the wells.

g. Please refer to the requirements outlined in R317-6-6.3 *Ground Water Quality Protection Rule, Utah Administrative Code.*

i. A ground water permit application must be signed by a corporate officer whose name, address and phone number must be included. If the operator is other than a corporate officer, then that person's name, address and phone number must also be given. This signature may appear on a letter of transmittal or on the cover page of the permit application itself.

ii. The application documents should be appropriately titled, e.g., *Ground Water Discharge Permit Application and Design Report for the OK Mine.*

iii. Please include the latitude and longitude for the facility.

h. The permit application must contain a Sampling and Analysis Plan which describes in detail the procedures for the sampling and handling and lists the lab method and detection limits to be utilized on a parameter by parameter basis. This plan must also describe quality assurance and control [QA|QC] protocols for validation of sampling procedures and data analyses. This plan will, then become an appendix to the ground water permit.

i. The application must include a waste rock management plan which describes the location(s) the waste rock will be placed, the characteristics of the waste rock and strategies to prevent pollution to waters of the state due to precipitation caused runoff and infiltration through the waste rock. It is understood that sulfide bearing ore or waste rock will not be removed or uncovered during the mining operation. The data that demonstrates that the waste rock will not be acid generating should be submitted in the revised application.

j. Potential discharges from the pad and process area need to be addressed in sufficient detail. Any data from pilot testing that indicates what specific pollutant concentrations might be expected from process waters at this site would fulfill this requirement. Process water

monitoring has not been proposed in the application. Some degree of monitoring will be incorporated into the permit such that the potential discharge can be defined.

k. A closure plan including neutralization criteria for abandonment of the heap leach spent ore piles and process ponds must be prepared for our review and approval, as a part of the ground water permit application.

4. OPERATIONS ISSUES

a. An operation and maintenance (O&M) manual for the permitted heap leach facilities must be submitted for review and approval before you begin the operation. The manual should address operational procedures, maximum leaching solution application rates, handling of solutions, inventory of solutions in the process ponds, procedures for a short term and a long term shut down, monitoring requirements, maintenance requirements, steps and procedures to prevent or minimize an overflow of solutions resulting from a series of storm events exceeding the design conditions and other approved operating basis etc. This information will enable operators to understand in detail the requirements of their jobs and to operate facilities according to intended design.

i. A monitoring document will define the frequency of monitoring, notification requirements of different quantities of fluids found in leak detection sumps, requirements of action if fluids found in the leak detection sump are verified as a leakage or exceed allowable amounts.

ii. A contingency plan for the worst spill scenarios for this project and appropriate response action for containment, minimizing the damage and possible remedies, will be submitted for review and approval, before operation of the pad can begin. The plan will define a course of action, resources available on site and notification requirements for the most probable spillage or leakage situation which may occur at this site. This could be added to your Emergency Response and Avoidance document.

iii. Records of the water balance for all fluids must be kept throughout the life of the project.

iv. Trigger mechanisms or threshold parameters tied to inventory of fluids that would require actions to prevent overflows, such as pumping fluids to other portions of the pad, building emergency containment structures, enhanced evaporation, treatment and discharge under emergency conditions, etc.

v. An annual evaluation of the operation and inventory of fluids for making necessary modifications to the operation, and accommodate any increase in storm water to the enlargement of the pad.

b. All process piping for this project will be contained within a larger pipe or lined ditch. Any spillage or leakage to such carrier pipe or ditch will be contained.

c. An asphalt liner would not be adequate containment for such spills. This is in reference to a statement on Page 5.1 of the report that it is very common to have numerous small spills around the tanks at the process plant. Secondary containment is recommended on the basis of frequency and severity of spills. All spills should be documented and reported.

d. The process plant and reagent forage areas should have concrete floors which slope to drains, sumps or waterways which will direct spillage or leakage to the process ponds.

e. Details of the solvent and grease handling and disposal facilities must be submitted for review.

f. Details of the storage areas which will contain spills, leaks, etc., must be provided for review such as containment berms, liners, conveyance to process ponds etc.

g. The figures given for the extractor and stripping tank volumes are inconsistent. For example, 1,800 cubic feet would be equivalent to 13,464 gallons as opposed to the 53,000 gallon figure given. This discrepancy should be corrected.

5. STORM WATER AND OTHER ISSUES

a. Storm water needs to be diverted away from all anchor trenches. An application for a Storm Water Permit should be made before you begin construction. The facility will be covered under a general permit for industrial facilities. Please contact Don Hilden, Ph. D., at 538-6146 for further information and assistance in this regard.

b. Provisions for sediment control during storm runoff for disturbed area related to this project must be addressed during construction and after completion.

c. The report states that storm water runoff will be negligible. Please submit the basis of design including calculations for diversion structures, and construction plans detailing the diversions structures based on a 100-year, 24-hour, storm event.

d. Please contact Mr. Bill Dawson for the review and approval of a subsurface domestic wastewater disposal system at the site. Any 5000-gallons per day or less disposal system must meet the requirements of R317-501 to 513, *Individual Wastewater Disposal Systems, Utah Administrative Code*. Larger systems treating more than 5000 gallons per day will be reviewed and approved by us, in accordance with the requirements of R317-5, *Large Subsurface Wastewater Disposal Systems, Utah Administrative Code.*

e. Any mine water generated from the mined areas will be either contained within the pits or used for process waste makeup. A permit to discharge or a UPDES discharge permit must be obtained from this office. The water may also be used for dust suppression if it meets the criteria for its intended use. Please refer to R317-1, *Utah Administrative Code,* for further guidance. You may propose such reuse with necessary details for our review and approval.

For any discharge to water courses, please submit an application for a Utah Pollutant Discharge Elimination System discharge permit available under R317-8, *Utah Administrative Code*.

When the foregoing comments are addressed satisfactorily, we will begin drafting a combined construction and ground water discharge permit. In the meantime, if we can be of further assistance, please let me know or contact Mr. Lyle Stott or Mr. Dennis Fredrick.

Best regards,

Kiran L. Bhayani, P.E., D. EE.
Manager, Design Evaluation Section

KLB:LWS:lws:erb

cc: Mr. Vearl Christiansen - Bureau of Land Management
Mr. Tom Munsen - Division of Oil, Gas and Mining
Mr. Wayne S. Thomas - Southwest Utah District Engineer
Mr. W.J. Dawson, Southwest Utah Public Health Department

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